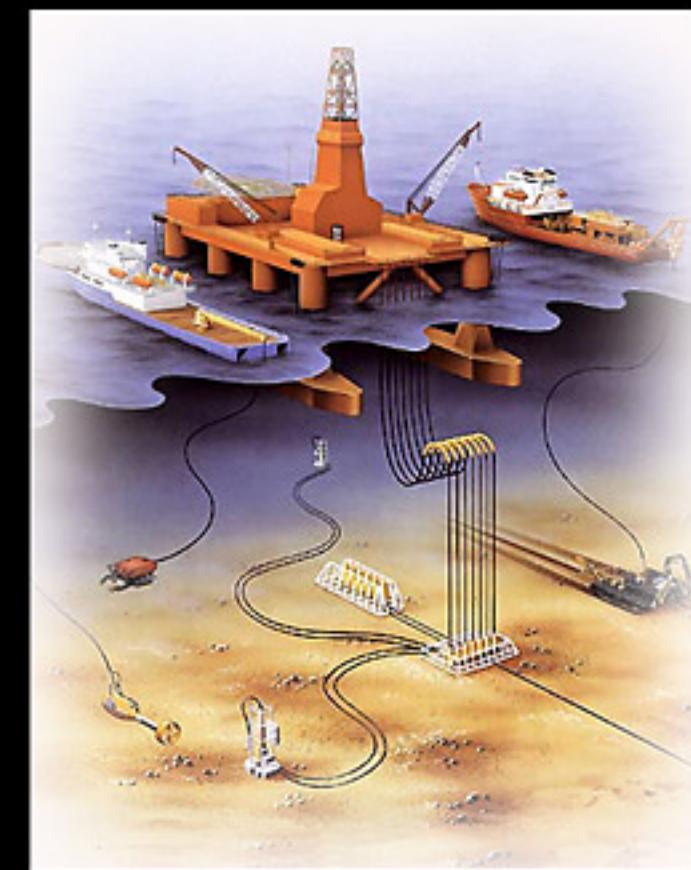


Multi-Level Parallel Paradigms for Flow-Induced Vibrations

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Parallel computations exploiting a single-level parallelism for VIV simulations have clear performance limitations that preclude scaling to the large number of processors on modern supercomputers. To take advantage of the hierarchical structures inherent in VIV computations, this article has presented two multilevel parallel paradigms based on MPI/MPI and MPI/OpenMP in the context of spectral element methods that completely eliminate the performance restrictions in single-level parallel computations. Because a greatly reduced number of processes are involved in the communications at each level, these multilevel parallel paradigms reduce the network latency overhead and enable the applications to scale to a large number of processors more efficiently. The multilevel parallel paradigms presented here are suitable for VIV computations at high Reynolds numbers.



Flow past a flexible cylinder subject to Vortex-Induced Vibrations (VIV) arises in numerous industrial and marine applications, for example, the flexible risers and tendons in petroleum production and marine tow cables

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